Not to be cited without
permission of the authors[1]

Ne pas citer sans
autorisation des auteurs[1]

DFO Atlantic Fisheries
Research Document 96/ 114

MPO Pêches de l'Atlantique
Document de recherche 96/114

Update on the Status of Unit 3 Redfish: 1996

by

Robert M. Branton

Marine Fish Division
Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Soctia
B2Y 4A2

[1]This series documents the scientific basis for the evaluation of fisheries resources in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the secretariat.

[1]La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

104-07146/

Abstract

The document summarizes commercial fishery and research survey data for Unit 3 redfish from January 1995 to July 1996. Most of the catch during the period was taken by small otter trawlers (less than 65 feet). The 1995 landings were approximately the same as in the previous two years, but well below the TAC. The 1995 fishery generally began in April, but declined after May, and was essentailly over by the end of October. The 1996 fishery generally began in April, with July showing highest landings to date, although they were somewhat less than for the same period in 1995. Redfish fishing operations using small mesh gear (i.e. <130 mm square) during the period were constrained by DFO management initiatives to avoid the capture of small redfish and bycatch of other groundfish species as well as conflicts with fixed gear. Commercial effort for otter trawlers were examined but many changes in the fishery made resulting catch rates impossible to interpret in the context of redfish abundance. Present biomass as judged from the 1995 and 1996 surveys is not greatly different than average since the late 1980s however there continues to be increased numbers of small redfish particularly in the area north and east of Brown's Bank. There is as yet no indication that this recruitment will result in a marked increase in biomass but combined with the low exploitation rates which currently prevail, should result in fishing and stock conditions in 1997 being very much the same as in recent years.

Résumé

Le document résume les données obtenues grâce à la pêche commerciale et aux relevés scientifiques concernant le sébaste de l'unité 3, de janvier 1995 à juillet 1996. La plus grande partie des prises de cette période était le fait de petits chalutiers à panneaux (moins de 65 pieds). Les débarquements de 1995 étaient à peu près équivalents à ceux des deux années antérieures, mais nettement inférieurs au TAC. En 1995, la pêche a en gros commencé en avril, mais a baissé après mai, et était pratiquement terminée à la fin d'octobre. En 1996, la pêche a en gros commencé en avril, et les débarquements de juillet étaient les plus élevés obtenus jusque-là, mais ils étaient un peu inférieurs à ceux observés sur la même période en 1995. Les opérations de pêche du sébaste avec des engins à petit maillage (maille carrée, < 130 mm) pendant cette période ont été restreintes par les mesures de gestion prises par le MPO pour éviter la capture des petits sébastes et les prises accessoires d'autres espèces de poisson de fond, ainsi que par les conflits avec les engins fixes. Nous avons examiné l'effort de pêche des chalutiers, mais les nombreux changements survenus dans la pêche nous ont mis dans l'impossibilité d'interpréter les taux de capture dans le contexte de l'abondance du sébaste. D'après les relevés de 1995 et 1996, la biomasse actuelle ne s'écarte guère de la moyenne observée depuis la fin des années 80, mais le nombre de sébastes de petite taille continue à augmenter, particulièrement dans la région située au nord et à l'est du banc de Brown. Rien n'indique pour le moment que ce recrutement puisse se traduire par une augmentation marquée de la biomasse, mais, étant donné les faibles taux d'exploitation qui prévalent actuellement, on devrait observer en 1997 des conditions de pêche et un état des stocks comparables à ceux des années précédentes.

Introduction

The Unit 3 management area for redfish (Figure 1) was first implemented in the 1993 Groundfish Management Plan. Redfish in this area were previously managed as part of a larger 4VWX management area. The predominant species is *Sebastes fasciatus* (Acadian Redfish), occurring in the deep basins and at the edge of the continental shelf, with *S. mentella* (Beaked Redfish) occurring in the deeper waters off the continental shelf. Differences between these two species are not readily apparent, therefore commercial and research catch are not routinely separated by species.

The 1987 4VWX redfish stock status report (Zwanenburg and Hurley 1987), and a series of previous annual reviews, established that there was inadequate scientific basis for an analytical assessment and for annual adjustment of TAC advice. The Total Allowable Catch (TAC) levels for the new management units introduced in 1993 were established on the basis of the sum of the 1991 TACs for the previous management units, prorated by historical (1981-90) catches in the statistical areas which comprise the new units. This resulted in a TAC for Unit 3 of 10,000 t in 1993.

The first scientific description of Unit 3 redfish was a report to the FRCC in autumn 1993 and was used as a basis for a recommendation for the 1994 TAC also of 10,000t (FRCC 1993). The spring 1994 stock status report (Branton and Halliday 1994) and the 1995 report (Branton 1995) both concluded that fishing and stock conditions in the coming year were not expected to differ greatly from those in recent years. As a result, the TACs for 1995 and 1996 were also set at 10,000 t.

The present report gives a description of the Unit 3 fishery for the period January 1, 1995 to July 31, 1996 and the Research vessel survey results for July 1995 and 1996. It pays particular attention to location and season of fishing, managment measures employed to limit the capture of small fish and bycatch of other groundfish species, and size compositions of the commercial and research catches. The status of the stock expected in 1997 is also discussed.

Starting in 1995, the summer groundfish survey, which is the primary source of population and size composition data for this stock, was enhanced to include redfish species identification techniques and extended from 200 fathom out to 400 fathom in order to cover redfish habitat at the shelf edge previously not covered by the survey. Results from these enhancements have not yet been fully analyzed and are therefore not included in this report.

Description of the Fishery

Redfish landings from Unit 3 (Table 1, Figure 2) gradually increased from the late 1970s, peaking at almost 7,000 t in 1986, followed by a decline to about 2,000 t in 1991. Provisional landings for 1995 were about 4,850 t, slightly less than 1993 and 1994 but well below the 10,000 t TAC. During the period 1991 to 1994 (Table 2), July generally had the highest landings, however in 1995 (Table 3), the peak month was May. The provisional landings for January to July 1996 (Table 4) was about 3,000 t, somewhat less than for the same time period in 1995.

In 1995, small otter trawlers (less than 65 ft) took most of the reported landings (Table 5, Figure 3) fishing primarily in the basins (Table 6, Figure 4). In contrast to 1994, they did not fully utilize their own quota allocation (Table 7), although they did catch a portion of the large vessel (EA) allocations under the Temporary Vessel Replacement Plan (TVRP) thus creating a discrepancy between the quota and landings reports by vessel class.

In 1995, large otter trawlers (greater than 65 ft) took only a small portion of the reported catch (Table 5, Figure 3) fishing in the basins and at the edge of the shelf (Table 8, Figure 5), citing gear conflict and bycatch of other groundfish on traditional redfish grounds as their major problem (Industry Consultation in Liverpool, September 1996).

The situation in 1996 to date (Table 9, Table 10, Figure 6, Figure 7) is similar to that in 1995 except the redfish allocation to vessels less than 65 feet was included in the Individual Transferable Quota (ITQ) management program for this fleet component.

Reports that small fish were being landed from an area north and east of Brown's Bank for use as lobster bait, which had started in 1994, continued again in 1995. On May 19, 1995, at industry's request, a portion of area 4Xo known as the 'Bowtie' was closed (Figure 8) to all otter trawlers. Test fishing and gear mesh trials were employed, but it was not possible to demonstrate that the small fish could be avoided as in 1994. The 'Bowtie' closure remained in place to the end of 1995 and was re-instated for 1996 starting Febuary 15. In addition, all of 4X was closed on July 5, 1995 to <65' vessels fishing for redfish but reopened on September 21 for 130mm square mesh gear only, however there was very little fishing under these conditions. For 1995 (Table 11, Figure 9) and for January to July 1996 (Table 12, Figure 10), the proportions of small redfish taken from other areas of Unit 3 were substantially less than from 4Xo.

Unit 3 redfish landings have traditionally had a high proportion of fish in the 20-25 cm range and port samples for the period 1984 to 1993 (Branton and Halliday 1994) indicate that landings of fish less than this size were rare. Thus, in 1995, DFO Science used a minimum size of 20 cm to examine the issue. However in 1996, DFO Operations used 22 cm as the minimum size for its Conservation Harvesting Plans (CHP) (Annand and Hansen 1996). It was not possible to find any direct evidence regarding the impact of the 22 cm minimum fish size provision, however the percentages of redfish landings under these sizes observed from commercial sources were:

Min. Size	1994	1995	1996 (to July)
20cm	8	10	7
22cm	15	18	15

Bycatch of other groundfish species in the directed redfish fishery has also been cited as a problem. In addition to limits of 2% each of cod and haddock (as a percentage of redfish catch) in 4VW and 10% of all other groundfish species in 4X, DFO Operations also implemented a number of mobile gear closures (Figure 8) in Unit 3:

Fleet	Species	Area	Portion	1995	1996
ITQ	redfish	4W	all	Jan 01-Jun 30	Jan 01-Jun 30
		4X	all	Jul 05-Sep 21	-
			130 mm sq. only	Sep 21-Dec 31	-
all	all groundfish	4W	Haddock Nursery	all year	all year
		4X	Brown's Bank	Feb 01-Jun 15	Feb 01-Jun 15
			Bay of Fundy E. of Margaretsville	Jan 01-Apr 30	Jan 01-Apr 30
	redfish	4X	Brown's Bank	Jan 01-Jun 30	Jan 01-Jun 30
			Bay of Fundy N. of 43°30'	all year	all year
			< 50 fathoms	-	all year

'Test Fishing' was required before the start of fishing for redfish in NAFO Divisions 4VW in both 1995 and 1996. Fleet sectors were controlled separately. Vessels fishing under offshore license conditions (including TVRP vessels) were permitted to test the area open beginning January 1, while the <65' mobile gear fleet (ITQ) license conditions closed the area from January 1 to June 30. Test fisheries, particularly in Area 1 resulted in sporadic closures throughout the year due to a combination of high bycatch and incidence of small fish especially pollock (Personal Communication with C. Annand, November 1996).

Landings statistics for 1995 (Table 13) indicate that pollock accounted for most of the bycatch in Unit 3 as a whole and that areas 4Xpq had the highest rates for all species combined. Both small trawler operators, (Industry consultation in W. Pubnico September 1996) and management (personal communication with J. Hansen, September 1996) did not consider the situation in 4Xpq to be a problem because this bycatch consisted consisted of legal sized fish and was counted towards the vessels' individual quotas or the company enterprise allocation (EA) of these species.

Landings statistics for 1996 (Table 14) indicate a continuation of the 4Xpq situation as well as illustrating the problem that large otter trawler operaters are now having in 4Xmno where their bycatch rates are ranging from 11 to 15%. The rates for each of these areas are all higher than the legal limit for 4X and well above what was encountered by these vessels in this area during the previous year.

Small trawler captains in Southwest Nova Scotia (Industry consultation in W. Pubnico September 1996) claimed that closures were a greater constraint on their operations than either gear conflicts or bycatch limits and would prefer gear based solutions instead of area closures, to small fish and bycatch problems.

Resource Status

The increase in catches during recent years, compared to 1992, resulted from an increase in fishing effort, reflecting decreased fishing opportunities for more valuable species, and not an increase in redfish abundance. The various closures and subsequent test fishing during 1995 resulted in reduced landings, particularly from 4Xo, traditionally one of the better redfish areas in Unit 3. These closures are expected to have a similar affect on the 1996 catch.

Fishing effort of small otter trawlers (Table 15) and large otter trawlers (Table 16) were examined, but many changes in the fishery (e.g. many new entrants, small fish closures, bycatch closures, ITQ management and the TVRP) would make the resulting catch rates impossible to interpret in the context of redfish abundance.

Survey estimates of population (Table 17; O'Boyle, Branton and Black 1996) are highly variable between years and show no obvious trend over time, however the population appears to have been quite stable in biomass, abundance and distribution since the late 1980s.

The size composition of survey catches (Table 19, Figure 11, Figure 12) have been variable between years, possibly as a result of the survey not covering all areas of the distribution particularly at the edge of the continental slope. In recent years there has been some evidence of more small fish in the area north and east of Brown's bank (Table 20, Figure 13, Figure 14). The numbers of larger fish have declined slightly (Figure 15), particularly in the eastern areas of the management unit and at the edge of the continental slope.

Recent survey biomass estimates indicate an exploitation rate of 7-9% (Table 18) and are likely conservative given the limited depth range of the survey and the semi-pelagic nature of redfish.

Outlook

Research vessel surveys indicate stability in the population biomass and suggest some improvement in recruitment in recent years. There is, as yet, no indication that this recruitment will result in a marked increase in the biomass but combined with the low exploitation rates which currently prevail, should result in fishing and stock conditions in 1997 being very much the same as in recent years. Landings of 10,000 t in 1997 would be consistent with an exploitation rate of 15% which is considered to approximate fishing at $F_{0.1}$ given that the survey biomass is conservative and the size of fish caught in it are largely in the size range exploited by the fishery.

Some fishing in 1995 and 1996 was again directed towards small fish because of their accessibility and a ready market, however these catches could not be avoided as easily as in 1994. Although the proportions of small fish in the catch overall remains quite low, if recruitment continues to improve, avoidance could become more problematic.

Acknowledgments

The author acknowledges with thanks the valuable assistance of Gerry Black, who prepared and/or greatly assisted with the preparation of the many of the maps contained herein.

References:

Annand, C., and J. Hansen 1996. Management Activities for 1995 and early 1996 Scotia Fundy Region. DFO Atl. Fish. Res. Doc. 96/34, 46 p.

Branton, R., and R. G. Halliday 1994. Unit 3 Redfish Population and Fisheries Trends. DFO Atlantic Res. Doc. 94/38, 33 p.

Branton, R. 1995. Update on the Status of Unit 3 redfish: 1994. DFO Atl. Fish. Res. Doc. 96/32 14 p.

O'Boyle, R., R. Branton, and G. Black 1996. Summer Groundfish Survey Update for Selected Scotia-Fundy Groundfish Stocks. DFO Atl. Fish. Res. Doc. 96/102, 49 p.

Zwanenburg, K. and P.C.F. Hurley 1987. Redfish (Sebastes spp.) in Management unit 4VWX: and assessment of present stock status. CAFSAC Res. Doc. 87/35, 34 p.

Table 1. Unit 3 redfish Canadian and Foreign Landings and TAC by year in Thousands of Tonnes.

Year	Cdn	Fgn	Total	TAC	
77	2.11	2.29	4.40		
78	1.20	2.02	3.22		
79	1.86	0.72	2.58		
80	2.87	0.89	3.76		
81	3.73	0.76	4.49		
82	3.09	1.58	4.67		
83	4.04	0.82	4.86		
84	4.57	0.87	5.44		
85	5.84	0.03	5.87		
86	6.62	0.06	6.68		
87	6.07	0.02	6.09		
88	3.90	0.04	3.94		
89	3.20	0.19	3.39		
90	2.26	0.12	2.38		
91	1.92	0.13	2.05		
92	2.37	0.12	2.49		
93	5.08	0.19	5.27	10.0	
94	5.17	0.01	5.18	10.0	
95	4.83	0.02	4.85	10.0	
96	2.92	0.03	2.95	10.0	(to July 1996)

Table 2. Annual average landed tonnes by statistical unit area and month for mobile gear fishing redfish in Unit 3 during the period 1991 to 1994.

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk			4	3	15	1	2	40	23	18	12	2	120
4Wl				2	6	2		4	8	5	1	3	31
4Xm			6	4	33		18	60	54	95	55	11	338
4Xn	3		3	5	29	105	120	72	10	4	6	5	361
4Xo	2	2		50	111	353	547	359	157	87	43	4	1715
4Xp	1	3	15	68	87	152	17	4	1	4	1		352
4Xq	1	1	6	6	31	21	9	3	3	1	1		84
Other	6		4	8	70	23	33	41	24	3	8	6	226
sum	12	6	38	145	383	657	746	584	281	218	127	31	3227

Table 3. Landed tonnes by statistical unit area and month for mobile gear fishing redfish in Unit 3 during 1995.

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk				16	16	45	21	1	24	13			136
4Wl		2	1	1	3	10	12				3	2	33
4Xm				81	459	231	67	46	124	193	45	34	1281
4Xn		13	2	18	263	67	35	6		5	9	1	419
4Xo			10	74	358	461	203	162	43	47	4		1362
4Xp	3		26	385	245	104	117	3	9				892
4Xq	1			149	83	123	31	2	100	41			531
Other						1	4	4					10
sum	4	15	39	725	1426	1041	491	224	300	299	61	38	4664

Table 4. Landed tonnes by statistical unit area and month for mobile gear fishing redfish in Unit 3 during 1996.

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk				168	183	110							461
4Wl		3	1		1	2							8
4Xm	50	59	5	6	112	148	39						419
4Xn		4	1		77	27	108						219
4Xo				18	142	219	666						1046
4Xp			10	8	7	24	12						62
4Xq	2	12	1	130	137	93	107						481
Other					1	1	30						32
sum	53	79	19	330	660	623	962						2727

Table 5. Unit 3 Canadian redfish catch by year and vessel type (main species redfish trips only) and all other catches in thousands of tonnes.

Yr	TC2+3	TC4+5	Other	Combined	
77	0.02	1.28	0.81	2.11	
78	0.00	0.87	0.33	1.20	
79	0.01	1.09	0.77	1.86	
80	0.12	1.99	0.77	2.87	
81	0.09	3.10	0.53	3.73	
82	0.36	2.01	0.71	3.09	
83	0.63	2.86	0.55	4.04	
84	1.53	2.46	0.58	4.57	
85	2.07	3.47	0.30	5.84	
86	2.38	3.65	0.59	6.62	
87	2.71	2.49	0.86	6.07	
88	1.43	1.69	0.78	3.90	
89	1.41	1.40	0.39	3.20	
90	0.37	1.43	0.47	2.26	
91	0.44	1.06	0.41	1.92	
92	0.36	1.55	0.46	2.37	
93	2.92	1.71	0.44	5.08	
94	3.84	1.01	0.31	5.17	
95	3.80	0.87	0.16	4.83	
96	2.50	0.22	0.19	2.92	to July

Table 6. Landed tonnes of redfish by statistical unit area and month for small otter trawlers in Unit 3 for 1995.

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk						42	15		16	13			87
4Wl							12						12
4Xm				64	352	94	27		81	178	42	34	874
4Xn			2	5	231	67	35	3					343
4Xo			10	56	328	406	203	122	23	10			1158
4Xp	3		26	369	243	104	117	3	8				873
4Xq	1			95	71	105	31	2	95	41			441
Other							4	4					9
sum	4		38	588	1226	819	445	134	223	242	43	34	3796

Table 7. Quota allocations and percent used by vessel type for Unit 3 redfish during 1994 and 1995.

Year	Vessel	Quota	Catch	%used
1994	<65'	3707	3569	96
	65-100'	2673	919	34
	>100'	3620	573	16
	total	10000	5061	51
1995	<65'	3707	2685	72
	65-100'	3023	929	31
	>100'	3270	1189	36
	total	10000	4803	48

Table 8. Landed tonnes of redfish statistical unit area and month for large otter trawlers in Unit 3 for 1995.

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk				16	16	2	6	1	8				50
4Wl		2	1	1	3	10					3	2	21
4Xm				17	106	136	40	46	42	15	3		407
4Xn		13		13	31			3		5	9	1	75
4Xo				18	30	55		40	20	37	4		204
4Xp				16	2				1				19
4Xq				55	12	18			5				90
Other						1							1
sum		15	1	137	201	223	46	90	77	57	18	4	867

Table 9. Landed tonnes of redfish by statistical unit area and month for small otter tralwers in Unit 3 for 1996 (to July).

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk				168	180	107							455
4Wl					1								1
4Xm	33	43	4	1	93	133	35						341
4Xn					75	25	108						209
4Xo				16	128	201	655						1001
4Xp			4	5	6	14	12						42
4Xq	2	11	1	104	116	83	106						424
Other					1	1	30						32
sum	35	55	10	294	600	564	947						2505

Table 10. Landed tonnes of redfish by statistical unit area and month for large otter tralwers in Unit 3 for 1996 (to July).

AREA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
4Wk					3	3							6
4Wl		3	1			2							7
4Xm	17	16	1	5	19	15	3						78
4Xn		4	1		2	2							10
4Xo				2	14	18	11						45
4Xp			6	3	1	10							20
4Xq		1		26	20	10	1						57
sum	18	25	8	36	60	60	15						222

Table 11. Numbers caught at length of Unit 3 redfish by otter trawlers in areas 4Wkl and 4Xmnopq during 1995. Numbers of samples (#) collected by National Sampling Program (NSP) and Observer Program (OBS), and percentages less than 20 cm (% lt 20) and 22 cm (% lt 22), are also given.

1995		4WK	4WL	4XM	4XN	4XO	4XP	4XQ	Total
Landed (t)		136	33	1281	419	1362	892	531	4654
Sampled (t)		28	4	194	48	141	88	14	517
NSP/OBS (#)		1/10	0/5	14/8	4/19	8/7	8/16	1/11	36/77
% lt 20		2	0	2	10	26	1	6	10
% lt 22		5	1	7	18	41	4	14	18
cm	10	0	0	126	0	0	0	0	126
	11	0	0	373	0	0	0	0	373
	12	0	0	373	0	4924	0	0	5297
	13	0	0	1361	0	16863	0	0	18224
	14	0	0	867	128	34016	188	0	35199
	15	0	0	1957	0	43479	56	3941	49433
	16	15	0	494	5681	82629	2145	1906	92870
	17	19	0	1180	6176	112185	2428	944	122932
	18	153	0	10789	21924	123292	7301	3811	167270
	19	347	0	10940	28559	181419	12778	9343	243386
	20	685	0	41008	52539	291403	17764	11896	415295
	21	597	71	56084	36919	259762	40233	18056	411722
	22	1613	117	92107	62505	280151	48758	27750	513001
	23	2465	96	180571	61165	333304	77719	24291	679611
	24	5452	182	241056	92523	298904	118743	33300	790160
	25	10520	167	414613	136427	295827	206379	41921	1105854
	26	13231	583	471100	122138	281071	227738	41755	1157616
	27	10354	669	394822	99351	235216	285641	41200	1067253
	28	10827	1044	367385	92505	156903	245916	46768	921348
	29	8058	1809	331874	68782	142038	244204	43179	839944
	30	3505	1571	182455	57531	109376	283327	47545	685310
	31	2381	3151	102354	29440	52834	194636	27454	412250
	32	1550	2959	86748	25521	52675	207922	35502	412877
	33	692	2158	40641	21162	35870	158374	23939	282836
	34	149	1865	16955	19492	20665	129657	12950	201733
	35	115	2032	5509	19226	13142	98494	13820	152338
	36	16	2503	3709	20960	7139	79996	9768	124091
	37	4	2245	2017	22163	2064	82254	8769	119516
	38	0	1895	476	18207	2302	79206	3256	105342
	39	0	1439	0	12710	0	46970	6346	67465
	40	0	1353	927	9104	304	49755	4514	65957
	41	0	1079	1114	8333	0	11950	241	22717
	42	0	1130	0	7773	0	11818	278	20999
	43	0	699	0	6121	0	3237	0	10057
	44	0	304	0	4919	0	565	0	5788
	45	0	390	0	3267	0	884	0	4541
	46	0	415	0	1588	0	94	0	2097
	47	0	345	0	1092	0	0	0	1437
	48	0	96	0	798	0	0	0	894
	49	0	51	0	184	0	0	0	235
	50	0	0	0	340	0	0	0	340

Table 12. Numbers caught at length of Unit 3 redfish by otter trawlers in areas 4Wkl and 4Xmnopq during 1996. (to July). Numbers of samples (#) collected by National Sampling Program (NSP) and Observer Program (OBS), and percentages less than 20 cm (% lt 20) and 22 cm (% lt 22), are also given.

1996 (to July)		4WK	4WL	4XM	4XN	4XO	4XP	4XQ	Total
Landed	(t)	461	8	419	219	1046	62	481	2696
Sampled	(t)	347	3	142	4	46	2	10	554
NSP/OBS	(#)	5/79	0/3	12/26	0/7	4/0	1/0	2/1	24/118
% lt 20		1	0	4	0	20	0	1	7
% lt 22		5	0	11	0	34	0	6	15
cm	10	0	0	0	0	0	0	0	0
	11	0	0	0	0	1470	0	0	1470
	12	0	0	90	0	0	0	0	90
	13	0	0	90	0	1470	0	0	1560
	14	0	0	90	0	4677	0	0	4767
	15	0	0	90	0	13200	0	0	13290
	16	0	0	3920	0	21990	0	0	25910
	17	208	0	9772	0	24987	0	0	34967
	18	170	0	10266	0	37274	0	0	47710
	19	2866	0	23349	0	40815	0	703	67733
	20	4663	0	40291	0	75403	0	1591	121948
	21	13806	0	80354	0	49026	0	4274	147460
	22	23097	20	88019	0	99528	0	9176	219840
	23	31963	20	129177	0	91542	0	7289	259991
	24	51998	20	177831	257	131257	0	11156	372519
	25	102329	66	265723	340	95365	0	10638	474461
	26	131623	86	324011	385	88291	0	10490	554886
	27	139639	20	261413	2313	61530	0	16003	480918
	28	124763	253	238395	3340	60270	113	17224	444358
	29	107360	299	207237	3267	57888	113	21183	397347
	30	67329	456	137118	3148	62182	320	32468	303021
	31	32374	892	101246	3432	24734	320	21812	184810
	32	19530	1084	72166	2423	18789	640	23976	138608
	33	11920	1165	48678	1707	9304	1280	24975	99029
	34	6407	1186	19375	1845	5821	1600	16983	53217
	35	2183	1353	11403	2817	6907	866	16928	42457
	36	951	1008	2499	2157	2867	433	11433	21348
	37	402	1054	1216	2294	3142	753	6919	15780
	38	186	1297	211	2817	702	1073	8473	14759
	39	72	1226	217	1863	0	2145	7197	12720
	40	36	942	0	1129	0	5344	2812	10263
	41	0	709	54	1147	0	3425	851	6186
	42	0	471	108	1138	0	3538	0	5255
	43	0	187	0	743	0	2578	0	3508
	44	0	238	108	1523	0	640	0	2509
	45	0	20	163	1799	0	207	0	2189
	46	0	41	0	697	0	0	0	738
	47	0	0	0	0	0	0	0	0
	48	0	0	54	312	0	0	0	366
	49	0	20	54	119	0	0	0	193
	50	0	0	0	46	0	0	0	46

Table 13. Percent bycatch of other groundfish species by the Unit 3 redfish fishery by: unit area and vessel type; species and vessel type; and unit area and species for 1995.

All Species = 11.2 %

Area	<65'	>65'	TOTAL
4Wk	7.4	6.6	7.1
4Wl	1.2	16.0	10.7
4Xm	8.8	7.4	8.4
4Xn	7.0	4.1	6.5
4Xo	8.2	12.3	8.8
4Xp	16.7	13.4	16.6
4Xq	20.3	18.2	19.9
Other	13.8	36.1	16.2

SPECIES	<65'	>65'
Pollock	6.0	6.9
Cod	1.8	1.6
White hake	1.8	0.3
Haddock	0.9	0.6
Cusk	0.5	0.1
Flatfish	0.4	0.1
sum	11.4	9.6

SPECIES	4Wk	4Wl	4Xm	4Xn	4Xo	4Xp	4Xq	Other	TOTAL
Pollock	5.5	9.0	6.7	4.4	4.5	6.5	10.3	4.9	6.2
Cod	0.6	0.3	0.8	1.2	2.1	2.3	3.1	6.8	1.8
White hake	0	1.0	0.3	0.3	0.2	4.6	3.9	0.1	1.5
Haddock	0.1	0	0.3	0.2	1.4	0.9	1.2	2.4	0.8
Cusk	0	0.1	0.1	0.2	0.1	1.6	0.7	0	0.5
Flatfish	0	0.1	0.1	0.1	0.5	0.6	0.6	1.3	0.3
sum	6.2	10.5	8.3	6.4	8.8	16.5	19.8	15.5	11.1

Table 14. Percent bycatch of other groundfish species by the Unit 3 redfish fishery by: unit area and vessel type; species and vessel type; and unit area and species for 1996 (to July).

All Species = 12 %

Area	<65	>65	TOTAL
4Wk	9.1	6.2	9.1
4Wl	12.7	14.3	14.1
4Xm	6.9	11.4	7.7
4Xn	10.9	13.5	11
4Xo	6.7	15.4	7.1
4Xp	32.5	24.7	31.4
4Xq	24.3	39.8	26
Other	5.8		5.8

SPECIES	<65	>65
Pollock	5.7	12.6
Cod	2.5	4.1
Haddock	1.2	0.9
White hake	1.1	1.6
Flatfish	0.4	0.2
Silver hake	0.2	0
Catfish	0.2	0
Cusk	0.1	0.1
sum	11.3	19.5

SPECIES	4Wk	4Wl	4Xm	4Xn	4Xo	4Xp	4Xq	Other	TOTAL
Pollock	6.5	12.2	5.4	4.3	2.6	10.1	14.9	2.8	6.2
Cod	0.5	0.1	1.4	3.2	2.6	5.7	5.1	0.9	2.6
Haddock	0.8	0.4	0.3	1.1	1.0	4.2	1.9	0.8	1.1
White hake	0.1	1.3	0.2	0.8	0.1	8.7	3.4	0.4	1.1
Flatfish	0.1	0	0.2	0.9	0.5	0.9	0.4	0.6	0.4
Silver hake	0.9	0	0	0	0	0.1	0	0	0.2
Catfish	0	0	0.1	0.6	0.2	0.1	0.1	0.1	0.2
Cusk	0.1	0.1	0.1	0.1	0	1.6	0.1	0.1	0.1
sum	9.0	14.1	7.7	11.0	7.0	31.4	25.9	5.7	12.0

Table 15. Unit 3 redfish fishing effort in hours and days by small otter trawlers during the period 1989 to 1995.

Yr	Hrs	Days	
1989	1833	313	
1990	879	107	
1991	736	96	
1992	1421	148	
1993	5095	540	
1994	9759	895	
1995	12656	1174	
1996	6978	787	(to July)
avg	4920	507	

Table 16. Unit 3 redfish fishing effort in hours and days by large otter trawlers during the period 1989 to 1996.

Yr	Hrs	Days	
1989	1310	157	
1990	684	165	
1991	1410	158	
1992	1686	189	
1993	1984	215	
1994	1861	184	
1995	1622	195	
1996	669	80	(to July)
avg	1403	168	

Table 17. Survey biomass (thousands of tonnes) and abundance (numbers per standard tow) estimates for unit 3 redfish from Scotia Fundy Summer Research Survey.

YEAR	BIOMASS	NUMBERS
82	72.7	76.5
83	122.8	121.3
84	106.0	90.1
85	17.0	18.0
86	93.2	71.7
87	63.1	57.5
88	83.4	91.1
89	27.7	29.0
90	61.9	81.6
91	24.9	38.4
92	116.0	118.8
93	69.6	75.5
94	50.4	76.3
95	45.6	61.1
96	50.1	79.7
Average	66.9	72.4

Table 18. Harvest rate (survey biomass/commercial landings * 100%) of Unit 3 redfish for the period 1982 to 1996.

Year	5yr Avg. Biomass	Landings	Harvest Rate(%)
87	79.1	6.1	7.7
88	80.9	3.9	4.9
89	65.0	3.4	5.2
90	57.7	2.4	4.1
91	59.0	2.1	3.5
92	62.8	2.5	4.0
93	63.9	5.3	8.2
94	58.4	5.2	8.9
95	61.4	4.9	7.9
Average	65.4	4.0	6.0

Table 19. Average number of redfish at length per standard tow by year for Unit 3 during the period 1982 to 1996. Total numbers per standard tow (total #), and percentages less than 20 cm (% lt 20 cm) and 22 cm (% lt 22 cm), are also given.

	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
total #	77	122	89	18	71	57	91	29	81	38	119	75	76	61	80
% lt 20 cm	5	3	20	35	8	5	8	32	14	39	2	10	32	17	23
% lt 22 cm	11	4	22	42	17	9	10	36	22	46	2	14	35	28	34
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0.2	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.1
7	0.3	0	0	0	0	0.1	0	0.1	0	0	0	0.1	0.1	0	0.1
8	0.2	0.1	0	0	0.1	0.2	0.1	0.1	0.2	0.4	0	0.5	0.2	0.1	0.2
9	0.2	0.1	0	0	0.1	0.6	0.2	0.2	0.7	0.3	0	0.9	0.3	0.1	0.4
10	0.2	0.5	0.1	0.1	0.2	0.5	0.4	0.4	0.5	1.4	0.1	0.4	0.9	0.1	0.2
11	0.1	1.2	0.3	0	0.3	0.3	0.8	0.8	0.3	3.8	0.2	0.6	1.9	0.3	0.8
12	0.1	0.8	0.4	0.1	0.3	0	2.1	1.1	0.3	4.3	0.1	0.6	3.4	0.3	1.9
13	0.1	0.2	1	0.2	0.2	0.2	2.2	1.1	0.4	0.6	0.1	0.5	3.6	0.5	1.9
14	0.1	0.3	2.5	0.6	0.2	0.1	0.6	1.2	0.5	0.7	0	0.8	3.6	0.6	1
15	0.1	0.2	4	0.9	0.2	0.1	0.3	0.8	0.4	0.7	0.1	0.7	3.1	0.9	0.8
16	0.2	0.1	4.5	1.1	0.4	0.1	0.3	1	0.7	0.6	0.2	0.6	2.5	0.7	1.4
17	0.3	0.2	2.9	1.2	0.6	0.2	0.2	1	1.8	0.5	0.1	0.6	2.1	1	2.5
18	1	0.2	1.6	1.2	1.2	0.2	0.1	0.8	2.3	0.8	0.5	0.8	1.6	2.4	2.6
19	0.8	0.2	0.7	0.8	1.6	0.4	0.4	0.7	3	1	0.5	0.8	1	3.6	4.2
20	2.1	0.1	0.6	0.8	2.8	0.8	0.4	0.4	3.9	1.1	0.3	0.9	0.8	2.3	5.2
21	2.1	0.7	0.9	0.5	3.9	1.2	1.4	0.5	3.3	1.4	0.6	1.6	1.2	4.4	3.9
22	2.5	0.9	0.8	0.2	4	1.6	3	0.6	3.7	1.8	0.5	2.4	1.7	4.2	4.4
23	6.1	2	1.6	0.1	2.6	1.5	4.5	1.3	5.8	2.2	6.8	3.6	2.8	4.2	6.5
24	8	5.6	1.7	0.1	3.5	1.8	6.2	1.6	9.6	2.2	10.4	5.6	4.5	5.3	6.1
25	9.3	9.5	4.7	0.3	3	2.7	9.5	1.4	11.3	2.1	18.4	7.2	7.3	6	5.9
26	8.7	19.7	4.4	0.4	5.2	5.3	10.2	1.8	8.3	2.1	19.7	7.2	8.4	3.8	6
27	5.9	22.3	7.7	0.7	5.3	6.7	10.2	1.1	8.1	1.8	13.3	6.3	6.3	3.3	5.9
28	3.7	12.5	9.1	0.9	4.9	5.8	8.4	1.4	4.1	1.6	15.5	7	5.5	4.1	5.7
29	3.8	9.3	5.8	1.1	4	5.4	6.8	1.2	2.6	1.2	8.8	5.8	4	3.5	4.2
30	5.5	9.1	4.9	0.9	4.1	4.8	5.7	1.2	2.7	0.9	6.5	4.9	3.6	2.2	3.4
31	4.2	7.3	5.1	0.8	3.1	5.2	5.6	1.4	2.3	1.3	4.1	3.1	1.8	1.4	1.2
32	6	7.8	6.4	0.9	3.2	6	4.1	1.2	1.5	1	3	3.3	1.3	1.8	1.7
33	1.6	3.9	5.3	1.1	1.8	2.4	2.6	0.9	0.9	0.7	4	2.7	1.1	1.2	0.6
34	1.2	2.2	3.8	0.4	2	1.4	1.5	0.7	0.9	0.3	2.2	2.3	0.5	0.9	0.3
35	0.4	1.6	1.7	0.4	1	1	1.4	0.6	0.4	0.2	1.1	1.1	0.3	0.8	0.1
36	0.5	0.4	1.5	0.5	0.7	0.4	0.8	0.4	0.4	0.1	0.6	0.9	0.3	0.2	0.2
37	0.4	1.2	2.1	0.5	0.8	0.2	0.4	0.4	0.2	0.3	0.3	0.5	0.1	0.4	0.1
38	0.3	0.4	1.3	0.6	1.7	0.1	0.4	0.4	0.1	0.2	0.3	0.4	0.2	0.4	0
39	0.1	0.4	0.9	0.2	2.6	0	0.1	0.4	0.1	0.3	0.2	0.3	0.1	0.1	0
40	0.2	0.3	0.6	0.1	2.5	0	0.1	0.3	0	0.2	0.2	0.2	0.1	0	0
41	0.1	0.2	0.5	0	1.9	0	0.1	0.1	0.1	0.1	0	0	0	0	0
42	0	0.1	0	0	0.9	0	0	0.2	0	0.1	0	0.1	0	0	0

Table 20. Average number of redfish at length per tow (adjusted for distance towed only) by year for survey tows made in statistical unit area 4Xo during the period 1982 to 1996. The number of tows (# of Tows) made, and percentages less than 20 cm (% lt 20 cm) and 22 cm (% lt 22 cm), are also given.

	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
# of Tows	5	8	6	3	7	7	10	7	8	6	7	6	7	7	5
% lt 20	97	1	13	0	21	0	3	56	20	42	3	28	76	8	18
% lt 22	99	1	14	0	25	2	4	61	27	62	7	33	79	16	32
5	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	62	0	0	0	0	0	0	3	0	2	0	0	1	0	0
7	62	0	2	0	1	0	0	4	1	0	0	3	0	0	0
8	18	0	1	0	2	0	0	7	1	6	0	10	10	0	0
9	1	2	0	0	1	0	1	2	9	0	0	12	9	0	2
10	4	2	4	0	6	0	2	3	14	2	0	5	12	0	4
11	6	9	11	0	5	0	4	3	6	1	1	5	28	10	3
12	1	6	8	0	4	0	3	3	6	2	1	5	63	10	2
13	1	1	5	0	7	1	2	6	8	3	1	6	70	16	3
14	0	2	6	0	4	1	1	7	10	6	0	9	95	13	13
15	1	1	9	0	5	1	0	4	4	10	1	5	58	13	13
16	4	0	6	0	7	1	1	4	9	7	2	5	41	9	13
17	6	2	6	0	6	1	0	4	27	7	3	6	41	8	53
18	1	0	7	0	10	0	0	4	32	7	3	5	30	17	57
19	4	3	0	0	15	1	1	6	33	10	3	5	13	22	54
20	2	4	2	0	7	13	2	2	44	15	11	7	9	46	100
21	2	16	6	0	10	14	2	3	13	17	6	8	11	92	79
22	0	18	2	0	3	64	3	5	15	7	29	12	11	114	109
23	1	57	15	0	3	58	9	6	15	4	29	12	20	113	146
24	0	171	9	0	9	46	10	3	36	4	26	24	6	136	134
25	1	268	21	0	12	75	21	3	65	4	27	24	13	150	96
26	0	649	26	0	19	174	25	3	51	2	26	14	11	86	45
27	0	758	64	0	29	236	41	3	72	12	17	25	7	60	71
28	1	424	86	0	44	125	48	4	59	4	12	14	4	101	59
29	0	303	33	0	14	373	35	9	52	7	13	17	6	89	54
30	0	282	19	0	20	106	30	3	67	4	23	17	9	71	47
31	0	218	25	0	20	171	24	2	60	5	21	6	15	40	29
32	0	236	33	0	26	206	28	0	31	1	36	9	2	99	13
33	0	113	32	0	27	68	40	0	22	3	33	5	4	64	6
34	0	63	22	0	28	39	43	0	14	2	54	0	5	50	7
35	0	50	8	0	9	32	22	1	6	0	30	3	4	44	5
36	0	9	7	0	2	0	5	0	13	0	39	3	4	14	5
37	0	27	6	0	0	0	9	0	6	0	9	1	1	42	2
38	0	8	4	0	0	0	16	0	0	0	3	0	2	22	0
39	0	7	7	0	0	0	5	0	8	0	3	0	1	14	0
40	0	4	8	0	0	0	5	0	0	0	0	0	0	0	0
41	0	1	3	0	0	0	0	0	2	0	0	0	0	0	0
42	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Figure 1. Unit 3 Management area for redfish.

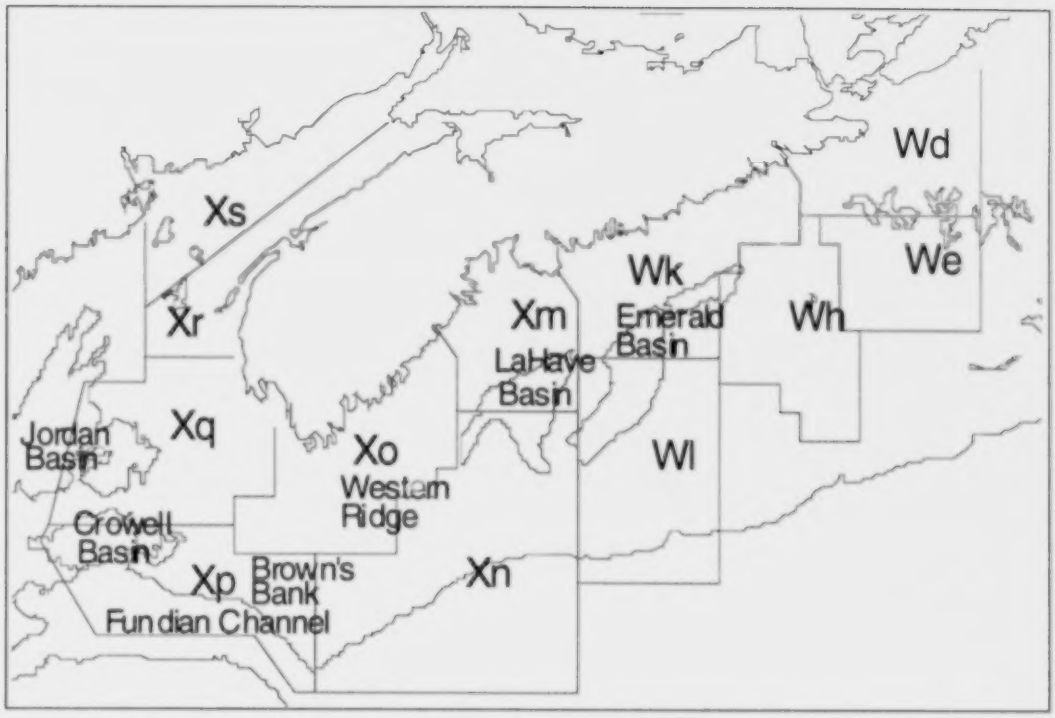


Figure 2. Canadian and Foreign Landings and TAC in thousands of tonnes for Unit 3 redfish during the period 1977 to 1995.

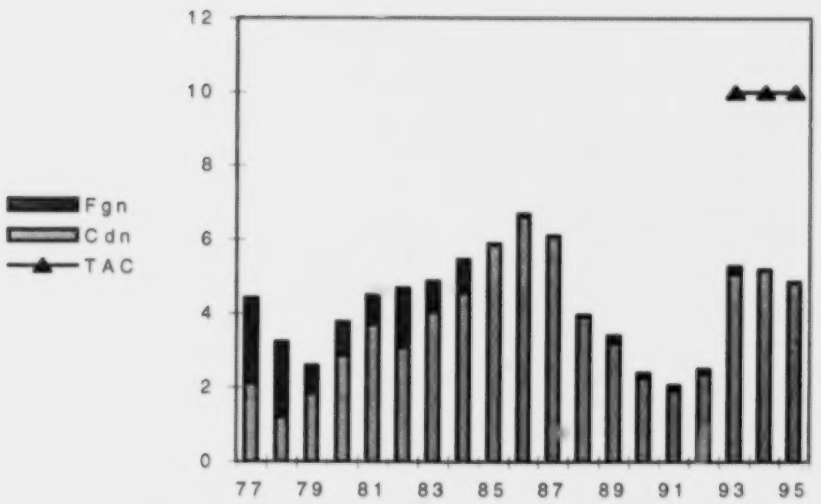


Figure 3. Unit 3 redfish catch by year and vessel type (main species redfish trips only) and other catches in thousands of tonnes during the period 1977 to 1995.

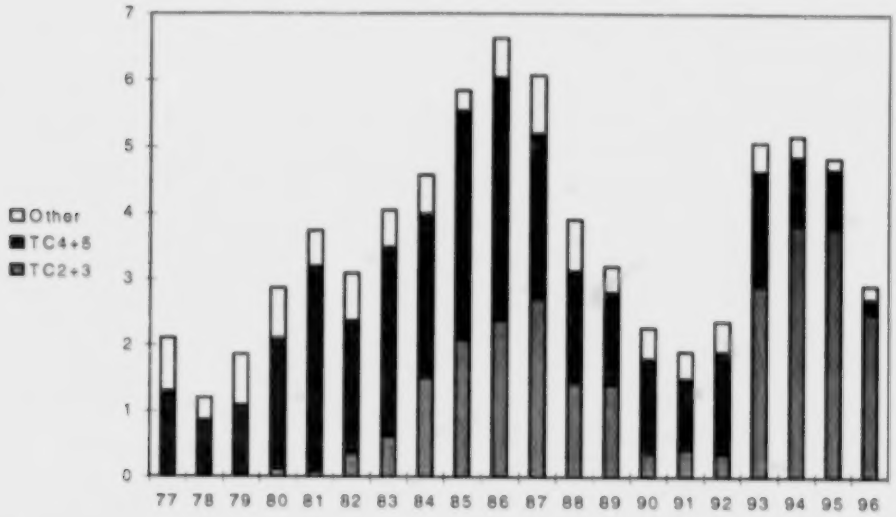


Figure 4. Geographical distribution of Unit 3 redfish catch (tonnes) by small otter trawlers in 1995.

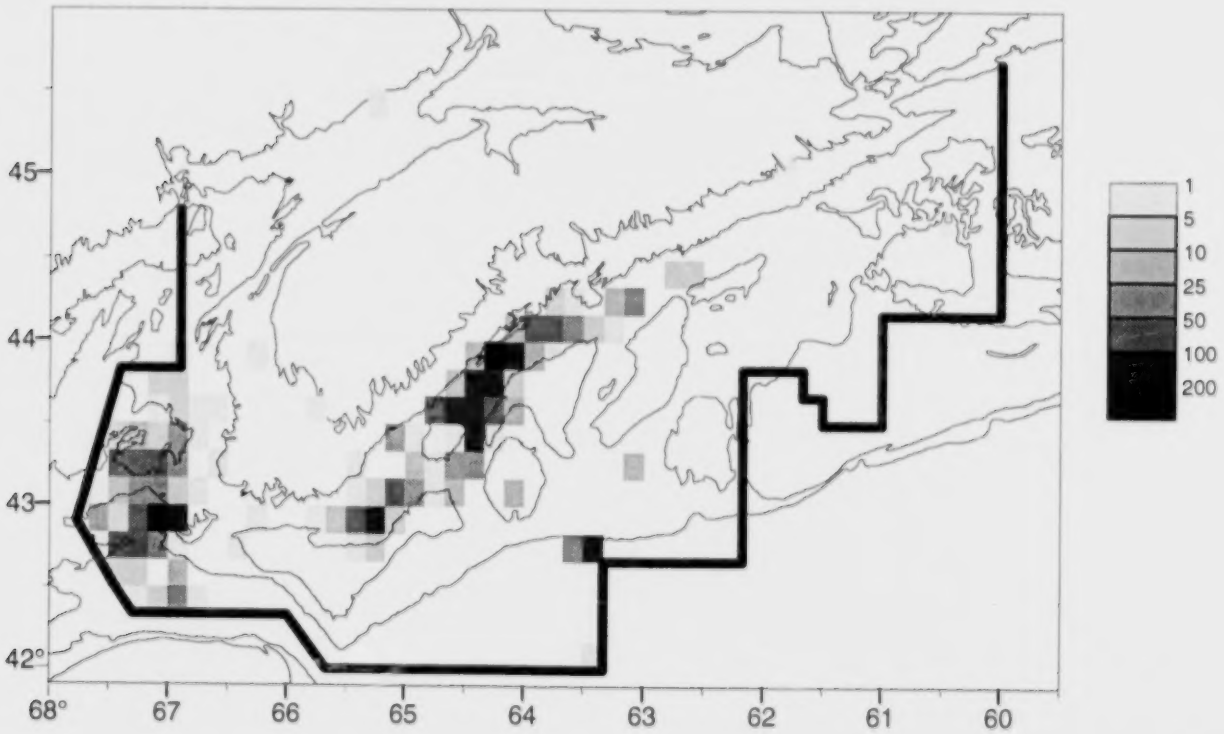


Figure 5. Geographical distribution of Unit 3 redfish catch (tonnes) by large otter trawlers in 1995.

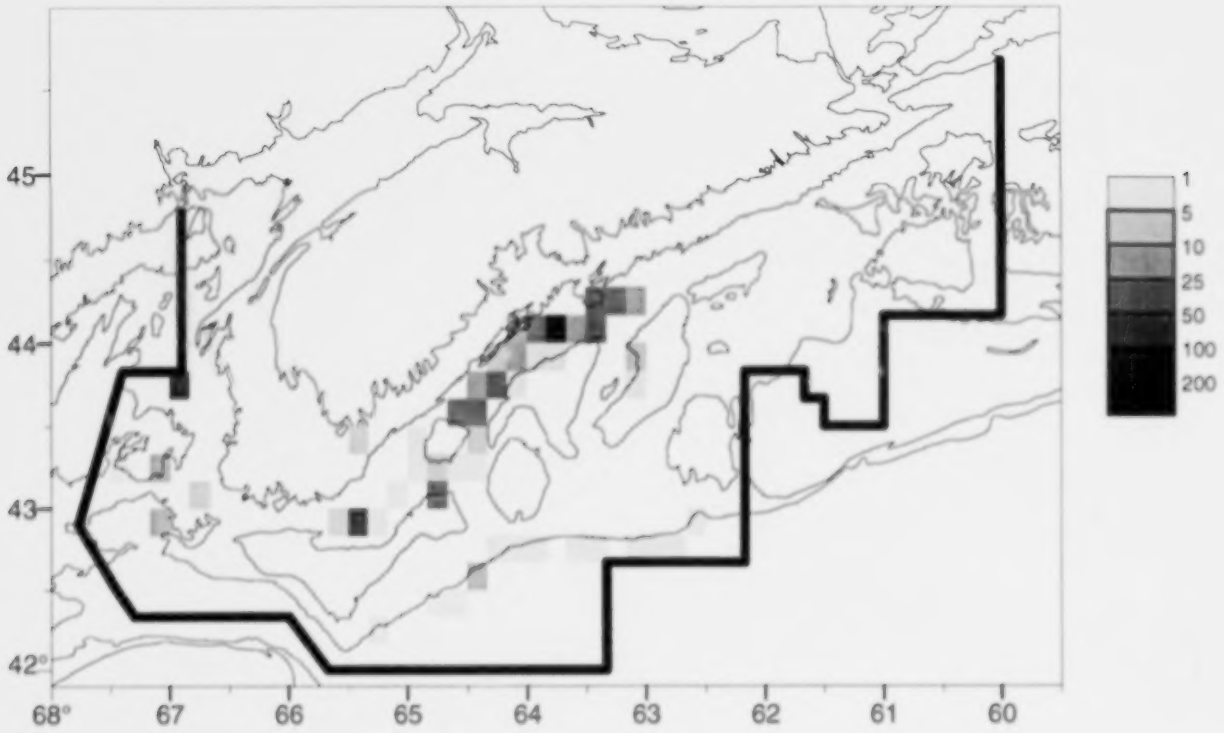


Figure 6. Geographical distribution of Unit 3 redfish catch (tonnes) by small otter trawlers in 1996 (to July).

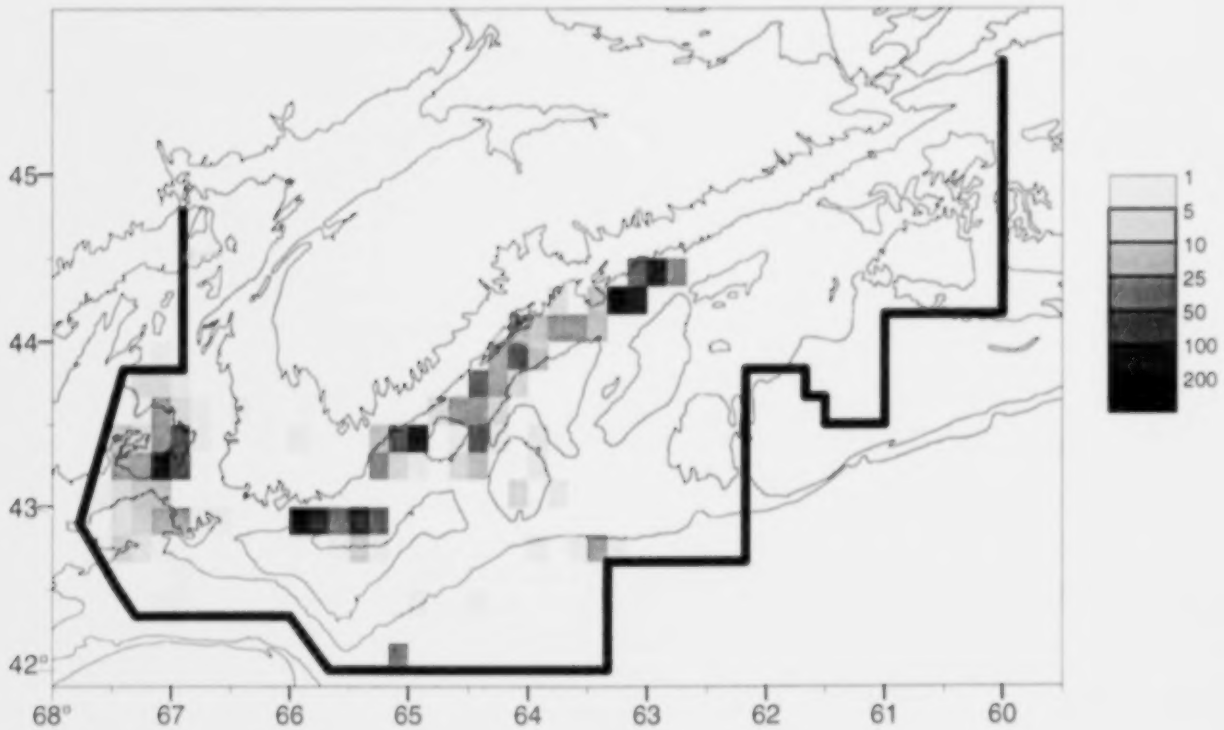


Figure 7. Geographical distribution of Unit 3 redfish catch (tonnes) by large otter trawlers in 1996 (to July).

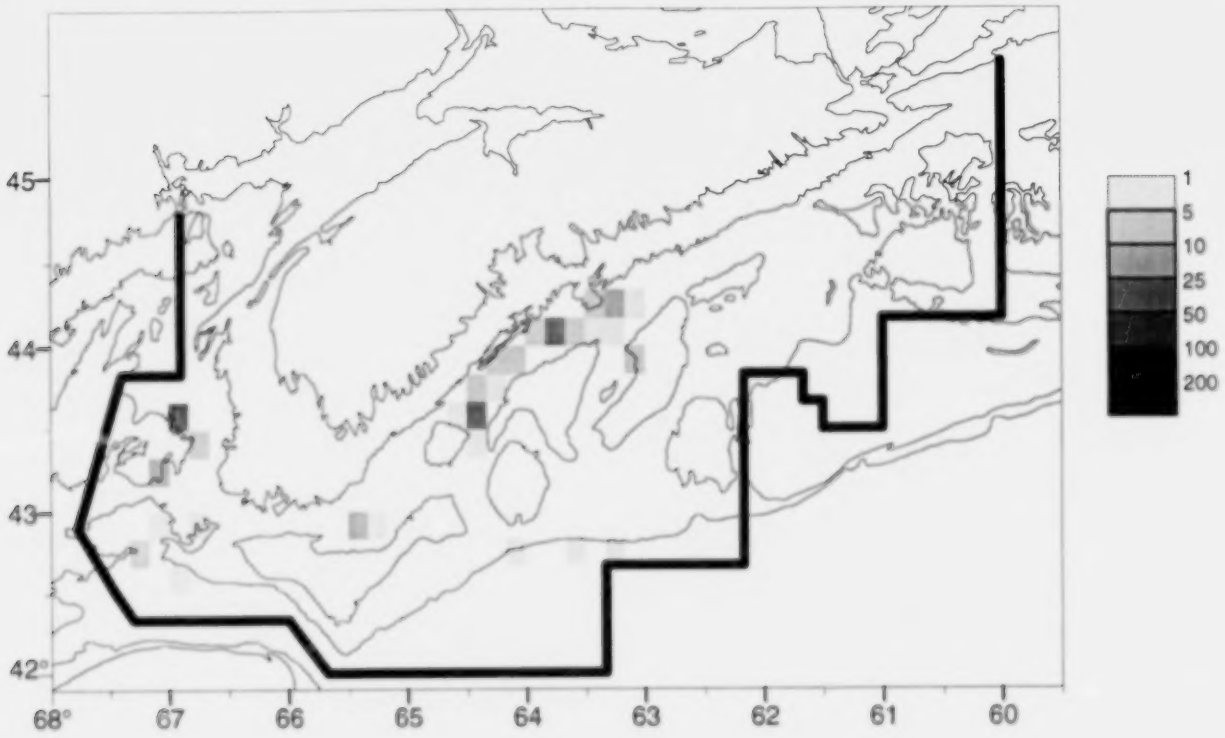


Figure 8. Unit 3 Small Fish and Bycatch closures for 1995 and 1996.

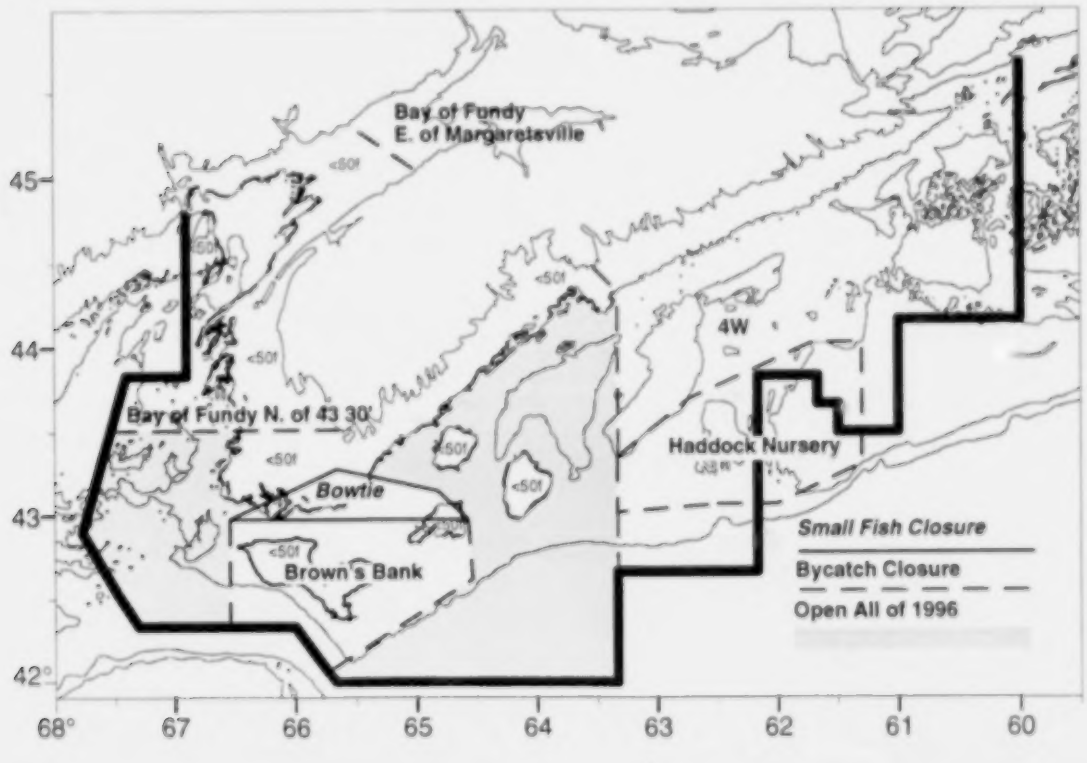


Figure 9. Unit 3 redfish commercial size composition (%) by unit area for 1995.

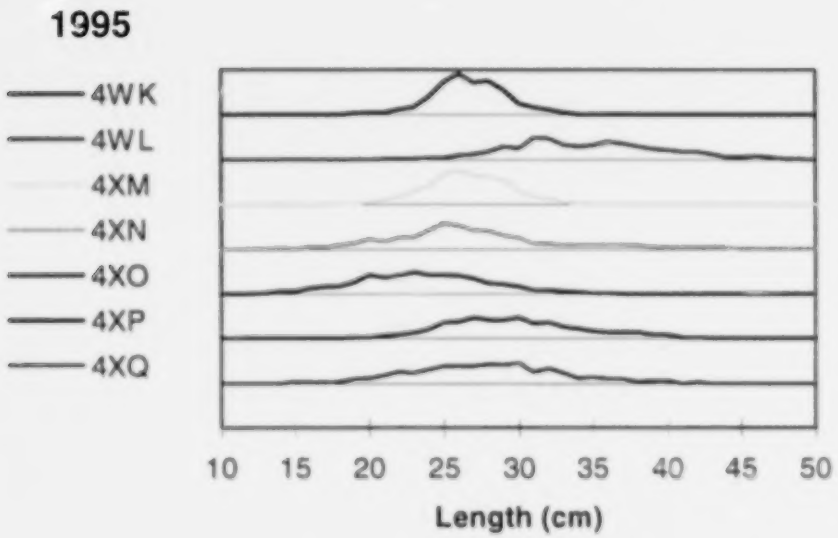


Figure 10. Unit 3 redfish commercial size composition (%) by unit area for 1996.

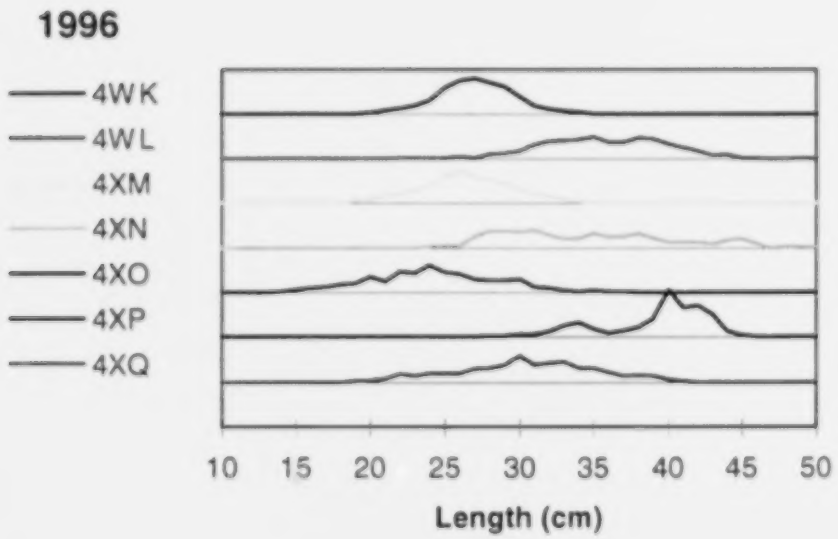


Figure 11. Size composition of survey catches for Unit 3 redfish from Scotia Fundy Summer Research Vessel Survey for the period 1982 to 1996.

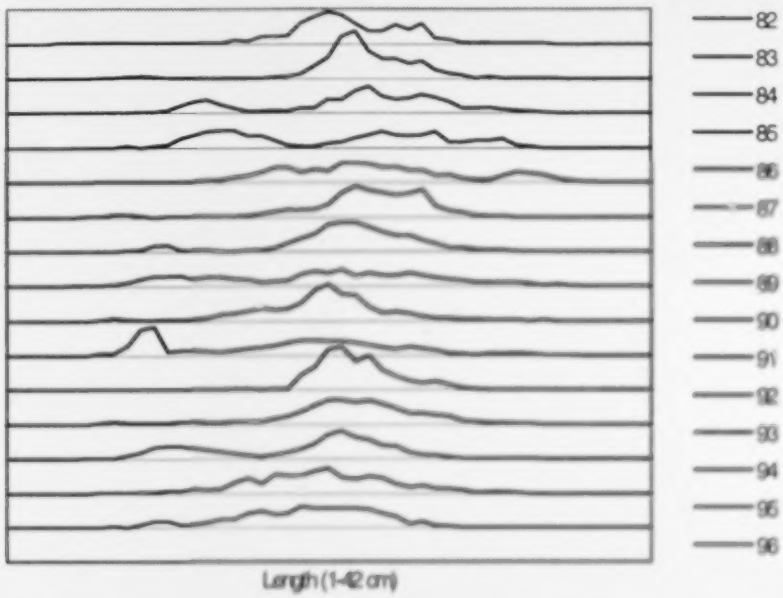


Figure 12. Unit 3 redfish stratified mean number per tow by size category from the Summer surveys.

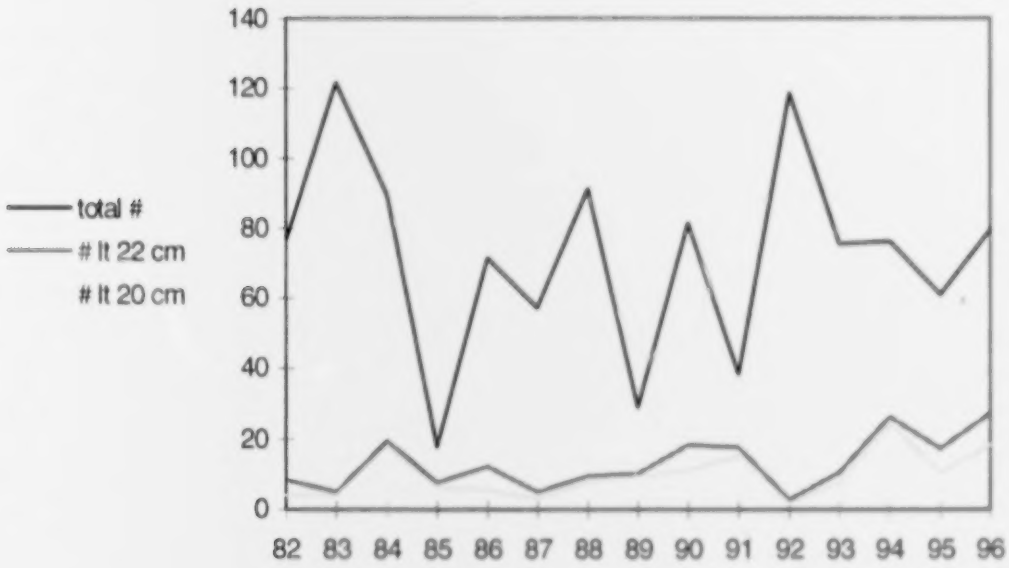


Figure 13. Average number per tow (adjusted by distance towed only) by size category for tows made in statistical unit area 4Xo, from the Summer surveys.

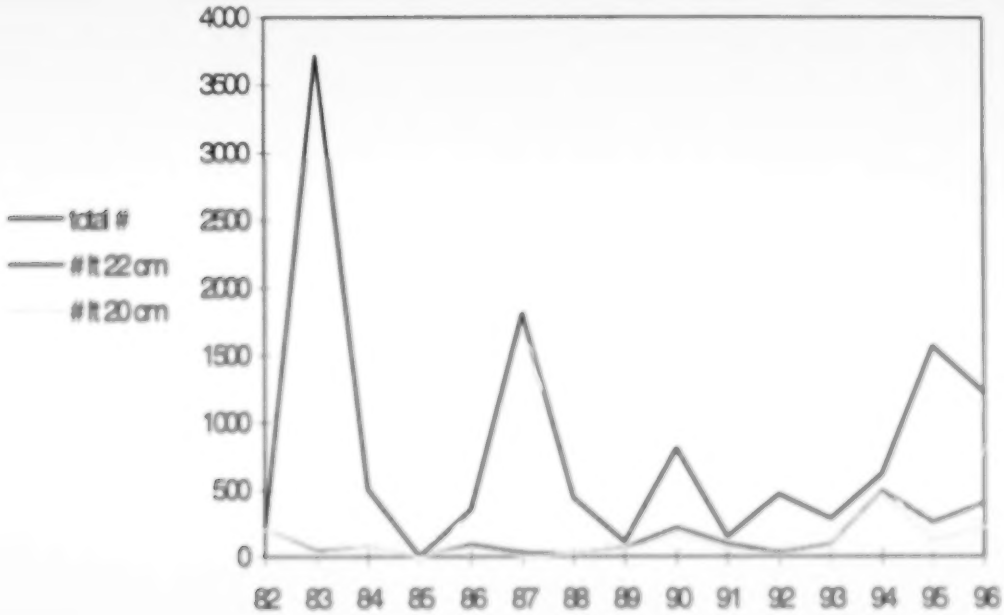
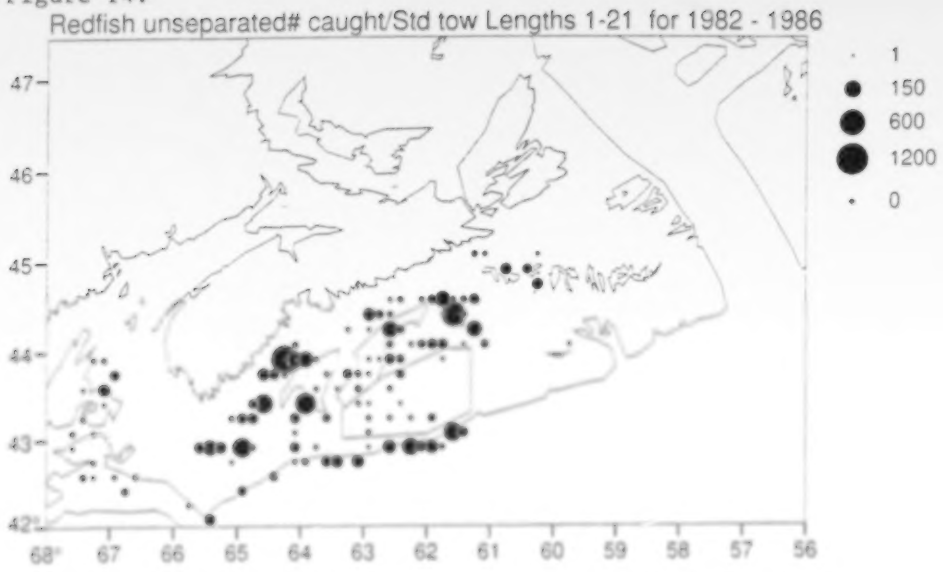
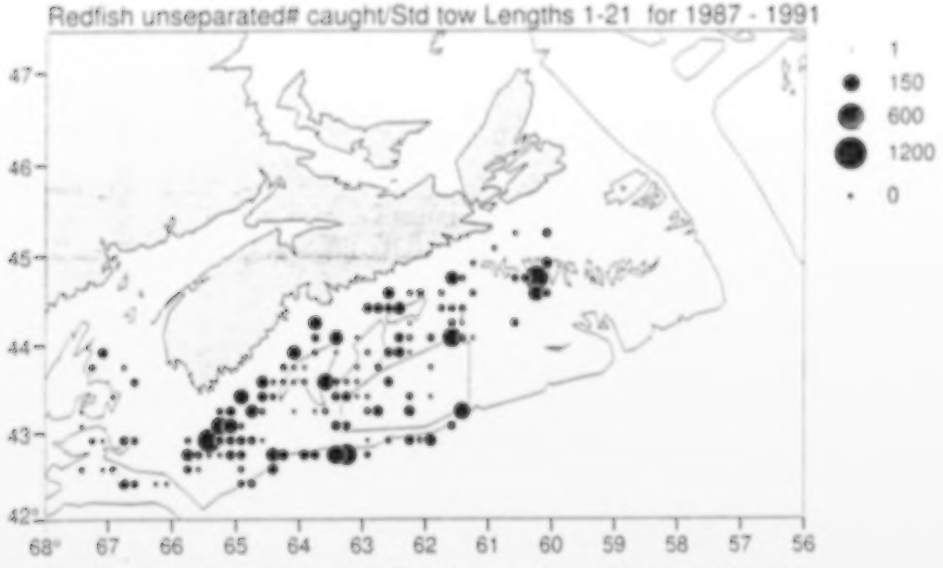


Figure 14.


Redfish unseparated# caught/Std tow Lengths 1-21 for 1982 - 1986
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56


Redfish unseparated# caught/Std tow Lengths 1-21 for 1987 - 1991
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56

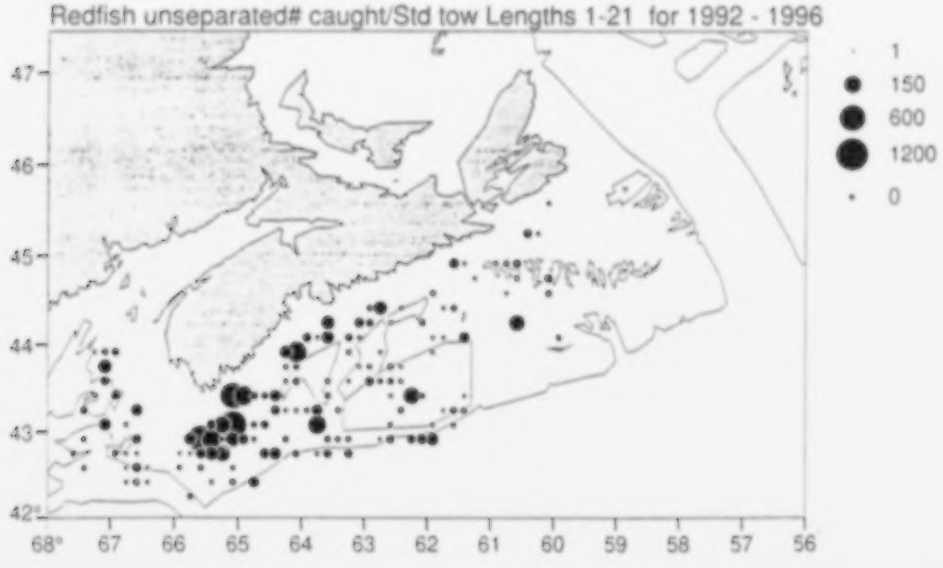
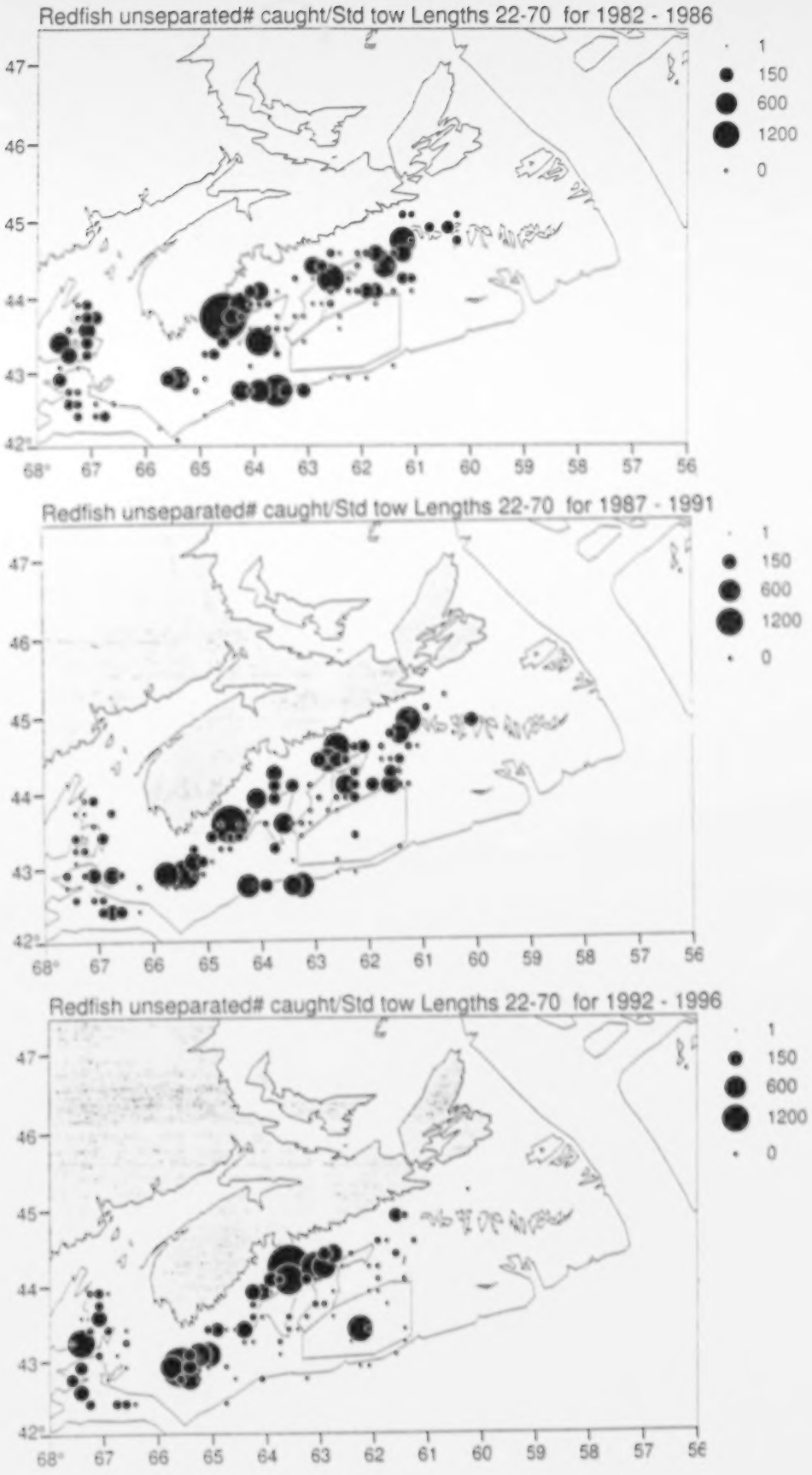

Redfish unseparated# caught/Std tow Lengths 1-21 for 1992 - 1996
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56

Figure 15.


Redfish unseparated# caught/Std tow Lengths 22-70 for 1982 - 1986
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56
Redfish unseparated# caught/Std tow Lengths 22-70 for 1987 - 1991
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56
Redfish unseparated# caught/Std tow Lengths 22-70 for 1992 - 1996
1
150
600
1200
0
47
46
45
44
43
42
68°
67
66
65
64
63
62
61
60
59
58
57
56